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DOUGH MIXER WITH METERING DEVICE

Specification

Dough mixers for producing dough used in preparing foods are known which utilize the function of one or two screw conveyors, of rotating mixing arms within fixed or rotating containers with vertical or angled axis, or of kneading elements rotating within a closed housing with a horizontal axis.

The specific level of technology is based on this last type of dough mixer, which thus uses the function of mixing elements rotating within a closed casing on a horizontal axis.

- The US 5,486,049 (apparati for mixing liquid substances) refers to a device for mixing liquid substances of varying degrees of viscosity. The stirring element of this device comprises a plurality of rungs that are arranged between two coaxial disks equidistant from each other and to their rotational axis.

- The US 4,630,930 (high-speed batch mixer) publishes a method and device for producing a portion of dough. The device comprises two coaxial chambers within which there are separate work phases performed by separate and different mixing or kneading elements. The ingredients for preparing the dough are introduced from above into the first chamber, where they are thoroughly mixed and then transported into the second chamber. In the second chamber they are kneaded by a kneading element that comprises parallel rungs, which are attached at both ends to corresponding radial arms that extend at the same angles and rotate about a common axis. The technical features of the second device requires a previous thorough mixing in a mixing chamber that is separated from the kneading chamber; the casing line of the inside casing surface of the

mixing chamber and of the kneading chamber have a rotational axis that is coaxial with the rotational axis of the kneading element.

- The US 5,322,388 (dough mixer) publishes a device for preparing dough which comprises a cylindrical chamber with a horizontal axis having in its upper region an opening for charging by free fall the ingredients that are used for preparing the dough, and in its lower region a closeable opening for discharging the prepared dough. The operation within the chamber takes place in the chamber's lower region by using several equidistant agitator blades on the same drive shaft with a rotational axis that is displaced but parallel to the chamber axis. The kneading chamber of this device can be opened because the disk-shaped vertical wall together with the agitator blades and the wall of the casing surface can be moved axially to the second vertical, disk-shaped wall, on which a scraper is located together with the corresponding drive motor.

- There are other smaller mechanical devices for preparing dough in the household; generally, they comprise a cylindrical container with a vertical axis within which one or more agitator blades operate on a single drive shaft that is attached coaxially to the container axis.

All of these known devices are not designed for preparing individual dough portions per each work cycle within relatively short periods of time and by charging with ingredients in individual portions; further, they do not provide that every individual mixed dough portion that is rolled into a ball and is ready for shaping and baking can be discharged without leaving ingredients or dough residue inside the device. The known devices are also not designed to perform a periodic, completely automatic sterilization of the kneading chamber and its kneading elements.

The problem is also known that the charging of the kneading devices with relative exact volumetric metering of the flour or flour-like or dust-like ingredients, which are more or less hydroscopic. Such problems are based on the tendency that flour-like material forms accumulations or agglomerates inside the container, that

varying the material volume above the metering mechanism strongly affects the metering process and that it is difficult to achieve an even filling and/or emptying of the metering chamber.

The object of the invention is to create a dough mixer as described above that has a simple and compact design, can be automatically sterilized, has an essentially cylindrical chamber with horizontal axis in which a kneading element operates with horizontally rotating axis, due to direct charging of the chamber with pre-metered ingredients per work cycle, to create in a short period of time a portion of dough which then is finally discharged as a mixed individual portion in the form of a ball and ready-made for subsequent shaping, garnishing, and baking or deep-freezing.

To attain the object of the invention, the invention proposes creating a housing with an inner chamber that is essentially cylindrical and has in its upper section, which corresponds to the charging region for the flour-like and possibly also liquid ingredients, as well as in the lower section, which corresponds to the discharge region, a surface area that runs parallel to the chamber axis and turns into the chamber casing surface. Within this chamber operates a rotating kneading element according to an axis that runs coaxially or parallel to the chamber axis, and this element comprises at least one arm formed with one end attached radially to the end of a drive shaft, and on the other end of which at least one fixed bearing pin is attached cantelever with an axis running parallel to the rotational axis of the drive shaft; a freely turning sleeve is placed by means of a recessed hole on top of this bearing pin with rounded terminal ends on both sides. As an advantageous feature are two arms extending radially from the same drive shaft, which are oriented to each other longitudinally or are in the same level but are at a certain angle to each other, and each of these arms carries a bearing pin with a rotating sleeve placed on top parallel to the rotational axis, preferably with a different distance to the rotational axis of the drive shaft. While these bearing pins, which are equipped with rotating sleeves, are in motion, the dough is compressed, rolled and rolled thin repeatedly in particular in the lower region of the chamber with the level surface section that turns into the curved casing surface. If a plurality of these sleeves are operated, they can have varying outside diameters, cross-sections, and shapes

depending on the consistency of the dough being produced and/or the properties of the ingredients and/or the percentage of liquid ingredients. The invention provides further for the interchangeability and/or the change in the number of the sleeves mentioned, depending on the properties of the ingredients and/or the dough that is being prepared.

Due to the charging of the chamber with dry flour-like ingredients, the kneading element carries out the work phase with the purpose of homogenizing and aerating the dried ingredients by rotating at a relatively high speed in order to achieve a better thorough mixing of the ingredients thus introduced, and their preparation for the subsequent introduction of liquid ingredients, which ensures that they are evenly absorbed, and the dough agglomerate is then created with a markedly reduced rotational speed; by further reducing the speed, a mixing and homogenization of the dough mass is achieved, which then, upon further reduction in rotation speed, is compressed and rolled into balls, which as such are discharged in part due to gravity by opening the discharge opening in the region corresponding to the lower level surface section of the chamber.

According to the invention, the individual inner surfaces and surface areas of the dough mixer chamber have surface transitions with rounded areas with the largest possible radius, including the rotating arms or the sleeves of the kneading elements, all have rounded forms, and thus the chamber space is free of edges or recesses on which dough residue could stick that is not discharged along with the individual portion, due to the process by which the dough is kneaded and rolled into balls. After rolling into balls and discharging, the chamber and the kneading elements are thus free of any residue from the dough and ingredients. This form further allows them to be sterilized by means of hot air, through which small amounts of sticky dough residue are removed in the air current due to the drying process and the application of pressure.

The front surface of the chamber, which is across from the second front surface from which the drive shaft for the kneading element projects, can have a level, conical, more or less rounded form that protrudes against the drive shaft, with its axis extending coaxially to the rotational axis of the drive shaft or parallel to it

preferably in the upper level of the chamber. By means of a distinctive conical or nose cone form, the rotating sleeves of the kneading element can roll the dough thin even with this shape. According to this invention, further, the housing wall that corresponds to this front interior surface with more or less distinctive shape can be replaced by another housing wall, in order to change the volume of the chamber by changing the distance between the front circular surfaces; in this case, the sleeves on the kneading element are also replaced by sleeves with the appropriate longitudinal extension.

It is advantageous that the liquid ingredient(s) for preparing the dough is/are introduced through one or more openings in the central region at the front wall across from the wall with the drive shaft.

In terms of the volumetric metering of the dry, flour-like ingredients, the invention proposes that a metering device be located in the region of the charging opening that is equipped e.g., with sliding blades, which essentially comprises a cylindrical container with vertical axis for the flour, and this container is equipped with a volumetric metering mechanism at its bottom. According to this invention, the container has inside in its lower region an annular, funnel-like partition, and the point of a distribution cone extends through the partition's central, circular opening so that an annular passageway is free for the flour. The container has at the bottom a metering sieve above which beaters move during the rotation of the distribution cone, which is driven by means of a vertical central shaft by a motor, in order to transport the flour through the metering sieve and through the holes which are positioned equidistant to the rotational axis on the metering disk located beneath it. The metering disk is located on the bottom disk, which is connected to the cylindrical wall of the container and which has an hole in the region of the charging opening of the dough mixer attached beneath it, through which the flour falls from the metering holes at the rotating metering disk and through the charging opening into the chamber of the dough mixer.

The invention does not exclude the possibility that the dough mixer, according to this invention, is fed from a metering device that has features other than those

proposed by the invention, or from a device which charges with a pre-measured portion.

The invention will be explained in more detail below based on a preferable exemplary embodiment that is represented schematically in the attached drawings of a dough mixer according to the invention that is charged according to the invention that prepares individual portions of 130 - 260 g within 10 - 15 seconds, which is especially suitable for preparing flat breads or pizzas.

Fig. 1 shows in cross-section a dough mixer according to the invention during the charging phase, which is linked to a metering device according to the invention, showing a sectional view according to the plane of section 1:1 in Fig. 2, which plane runs through the axis of the drive shaft of the metering device.

Fig. 2 shows the dough mixer according to the invention and as shown in Fig. 1 together with a metering machine in sectional view according to the plane of section II-II shown in Fig. 1.

According to this invention, the dough mixer for preparing individual portions comprises a housing 1 with an inner chamber and a kneading element 4, 4c, 4d, containing a charging opening 2a and a discharging opening 3a, 1d, with corresponding blades 2, 3. The essentially cylindrical chamber with horizontal axis is delimited by a level, circular surface 1e from which a shaft 12a extends coaxially, by a circular surface 1f corresponding to the aforementioned but with a conical form projecting slightly into the chamber, by two curved surfaces 1a with a casing line equidistant from the chamber axis, by an upper level surface section 1c that essentially corresponds to the region of the charging opening 2a, and by a lower level surface section 1b, which is larger than the upper one and corresponds to the region of the discharging opening 1d, 3a.

The kneading element comprises an arm 4 which is fastened on its front side at the end of the drive shaft 12a that extends into the chamber; at each of the ends of arm 4 a pin 4c is fastened having an axis running parallel to the rotational axis of the drive shaft 12a, and a freely turning 4b sleeve 4d with a rounded, hemispherical or

nose cone-shaped terminal area is placed on each of pins 4c by means of a recessed hole. Arm 4 of the kneading element is fastened to drive shaft 12a, off-center relative to the center line of the transverse-extending arm, such that two pins 4c with sleeves 4d attached to it turn with varying radius about the rotational axis of drive shaft 12a, which is driven by the electric motor 12 at varying rotational speeds and changing rotation directions.

Charging opening 2a for the introduction 14b of the flour-like ingredients in the upper region and discharging opening 3a, 1d for the individual portions of dough balls in the lower region, are provided with sliding blades 2, 3, which for example are moved 2b, 3b by pneumatic cylinders 2c, 3c without excluding the use of rotating blades and other drives.

Liquid ingredients are charged via a single hole 13 or via specific holes for each of the liquid ingredients, which holes are conical and all preferably disposed on the disc-shaped wall 11 in the region within the track of sleeve 4d, which turns with smaller radius about shaft 4a. Same hole 13 can be used for blowing in hot air to clean and/or sterilize the chamber and rotating kneading elements 4, 4c, 4d. The method for preparing dough with the dough mixer according to this invention, has essentially the following phases:

- Charging 14b with flour- or dust-like ingredients,
- Homogenization and aeration of the flour- and/or dust-like ingredients,

- Charging 13a with liquid ingredients,
- Preparing the dough,
- Rolling the dough thin,
- Compacting and rolling the dough into balls
- Discharging the individual dough portions

Following production of a pre-programmed number of dough portions and based on the production intervals, the chamber of the dough mixer is cleaned and sterilized with hot air.

- Charging 14b with flour-like and/or dust-like ingredients is by free fall through charging opening 2a equipped with sliding blades 2, which is driven 2b by pneumatic cylinder 2c. The construction and operation of the metering device, in accordance with the invention, with discharging opening 5e, corresponding to charging opening 2a of the dough mixer with which it is connected, will be explained later.

- The flour-like and dust-like ingredients are homogenized and aerated by rotating kneading element 4, 4c, 4d at a relatively high speed (approx. 2,500-3,000 rpm) that creates a favorable dispersion of the ingredients due to the special form of the chamber and kneading elements, wherein the particles of the dry ingredients are prepared for even absorption of the liquid ingredients following charging 13a.

- The dough mixture is prepared by rotating 4a kneading element 4, 4c, 4d at a lower rotation speed (approx. 950-1,400 rpm); this phase is followed initially by the formation of little dough clumps, which are then rolled together by the repeated action of rotating 4b sleeves 4d.

- The dough is then prepared by rotating kneading element 4, 4c, 4d at an even lower rotation speed (approx. 850-920 rpm); especially in this phase, the dough is repeatedly and intensely rolled out and rolled thin by the turning 4b sleeves 4d, particularly at lower level surface section 1b. The formation of a compact, balled together dough mass follows at an even

lower rotation speed (approx. 700-820 rpm), thus taking on the form of a "dough ball" at the end of this phase.

- The "dough ball" is discharged by centrifugal force via the rotating kneading element and by gravity through discharging opening 3a, which is opened by activating 3b blade 3 by means of pneumatic cylinder 3c.

During the various work stages, in particular during compacting, rolling out, and balling together the dough, it can be advantageous to make one or more changes in rotational direction 4a of kneading element 4, 4c, 4d. Liquid ingredients can be charged 13a more or less in stages and while kneading element 4, 4c, 4d is rotating. For cleaning and/or sterilization of the chamber by injecting hot air, the cool air of motor 12 that drives 12a the kneading element or the air that is diverted from the pneumatic system can be used, the air being heated prior to its injection into the chamber.

The volumetric metering device for the dry flour-like ingredients according to the invention comprises a cylindrical container 5, 5a, 5b with vertical axis, a distribution cone 7 with beaters 7a, 7b rotating 8a coaxially to the container axis, and a metering disk 9 with metering holes 9a on the rim which form the volume units for creating a total portion of flour 14 to be charged 14b into the dough mixer in order to generate a single portion of dough.

Cylindrical vertical wall 5 is sealed with bottom plate 5b, which provides a seating 5c for the bottom end of a vertically rotating 8a shaft 8 that is centrally seated 5d in cover plate 5a. The upper end of shaft 8, which extends beyond the cover plate 5a, is equipped with a pulley 8a driven by the belt 8b of a motor 11 attached to the container. Shaft 8 can naturally be driven in other ways and by other sources of power. Inside, in the lower region, the container is equipped with an annular, funnel-like partition 6 for directing flour 14 in the direction of the container axis. The upper region of a distribution cone 7, which is connected to drive shaft 8, extends through the central opening in partition 6 such that an annular duct 6c results for flour; beaters 7b that extend down from the cone 6 and move closely above partition 6 cause flour 14 to pass through 14a. Partition 6 and cone 7 prevent

variations in the fill level of flour 14 and thus the weight above partition 6 from having an affect on the metering mechanism disposed beneath. This mechanism comprises metering disk 9 with holes 9a on rim that rotates together distribution cone 7 and drive shaft 8; individual holes 9a, which are equidistant to the axis of rotation of the disk, represent with their volume the metering unit for creating the charging amount. Above metering disk 9 is a sieve 10 equipped with ducts 10a through which the flour is moved through at least one beater 7c which sticks out from cone 7, and turns with drive shaft 9, and moves above sieve 10. On the underside, metering disk 9 lies on top of bottom disk 5b of the container. Bottom disk 5b has an outflow through hole 5e that corresponds in diameter to holes 9a on metering disk 9 or is of a greater diameter and in the region of the passage of these holes. Practice has shown that the construction described here allows volumetric metering that is independent of the fill level in the container, the moisture level and other physical properties of the contents, which metering is sufficiently constant and can be varied by one or more volume units that are determined by individual holes 9a on metering disk 9. This feature of the metering device is fundamental for achieving homogeneity in the individual dough portions, which requires charging with calibrated, homogeneous ingredients and attains this above all by assuring that the mixture does not put weight on the metering mechanism in a single casing 5, 5a, 5 which is fed via a relatively narrow annular duct 6c and, affected by simultaneous mixing motions in the container region above the partition 6 and in the emptying region of the metering holes 9a and at the metering disk 9. Naturally, the amount of flour 14, which moves through annular duct 6c, must be at least as great, preferably somewhat greater than the amount which is fed to the dough mixer for the purpose of maintaining the individual portion of dough.

The invention does not exclude the possibility of linking the metering device according to the invention to a dough mixer or another device that does not correspond to the dough mixer according to the invention.